



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

Hepaticae of Puerto Rico

III. HARPALEJEUNEA, CYRTOLEJEUNEA, EUOSMOLEJEUNEA AND TRACHYLEJEUNEA

BY ALEXANDER W. EVANS

(WITH PLATES 20-22)

HARPALEJEUNEA

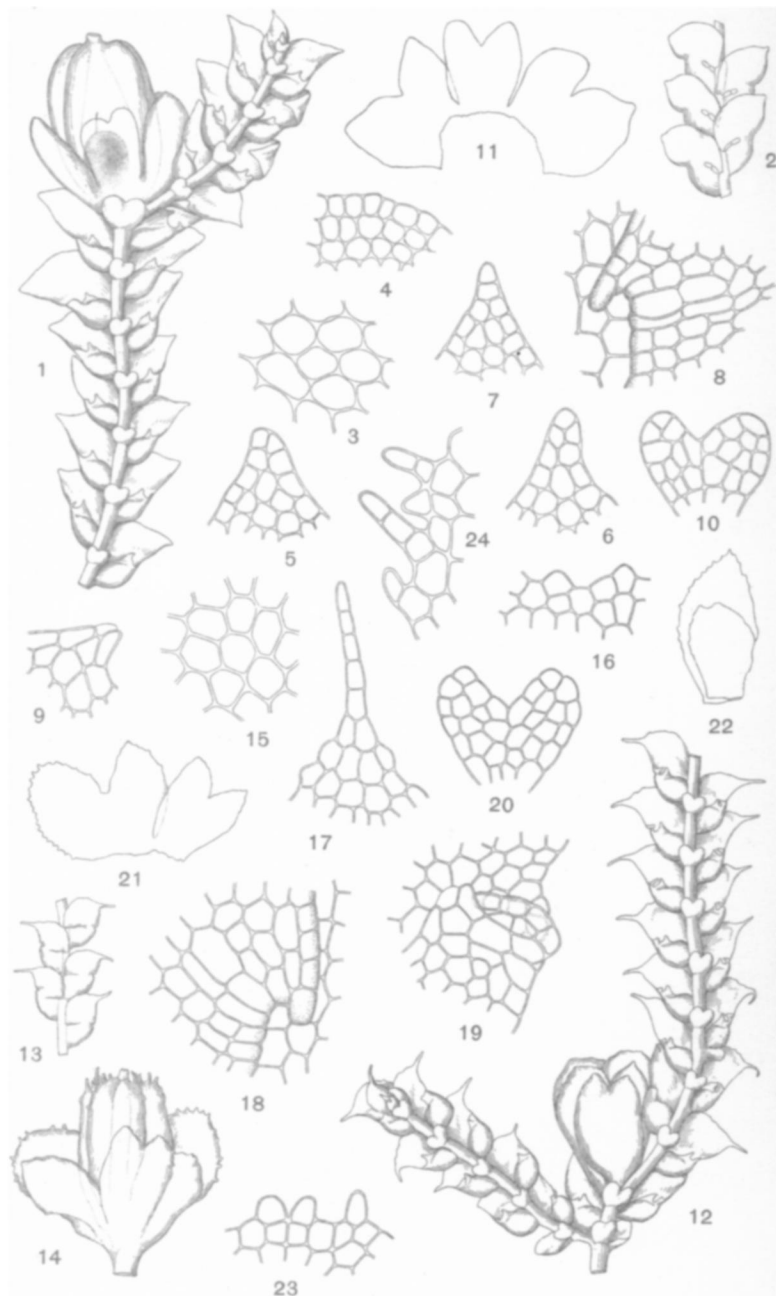
The subgenus *Harpa-Lejeunea* as first limited by Spruce included three sections.* In the first of these, *Cardiostipa*, the underleaves were described as cuneate-obcordate or cuneate-bifid with very obtuse angles or segments; while in the second, *Cyclostipa*, they were said to be suborbiculate and, with a single exception, bifid to the middle with acute or very rarely obtuse segments. The exception was *Lejeunea holostipa* Spruce, a species with undivided underleaves. The third section, *Strepsi-Lejeunea*, was made up of more robust forms with strongly thickened cell-walls and much larger underleaves. Spruce implied at the beginning that this third section was almost of subgeneric value and a few years afterwards wrote of it as a subgenus. When Schiffner elevated Spruce's subgenera to generic rank, he made two genera, tentatively at least, out of the subgenus *Harpa-Lejeunea* as originally defined.† For the first of these, which still included the sections *Cardiostipa* and *Cyclostipa* of Spruce, he retained the name *Harpalejeunea*. To the second he naturally gave the name *Strepsilejeunea*. Both of these genera are fully recognized by Stephani.‡

The sections *Cardiostipa* and *Cyclostipa* are really of unequal value. *Cardiostipa* is a very natural group, characterized especially by a peculiar type of underleaf, while *Cyclostipa* is made up of rather heterogeneous elements. This fact was clearly recognized by Spruce, who stated that his three species, *L. holostipa*, *L.*

* Hep. Amaz. et And. 164. 1884.

† Engler & Prantl, Nat. Pflanzenfam. 1³: 126, 127. 1893.

‡ Hedwigia, 35: 97, 127. 1896.



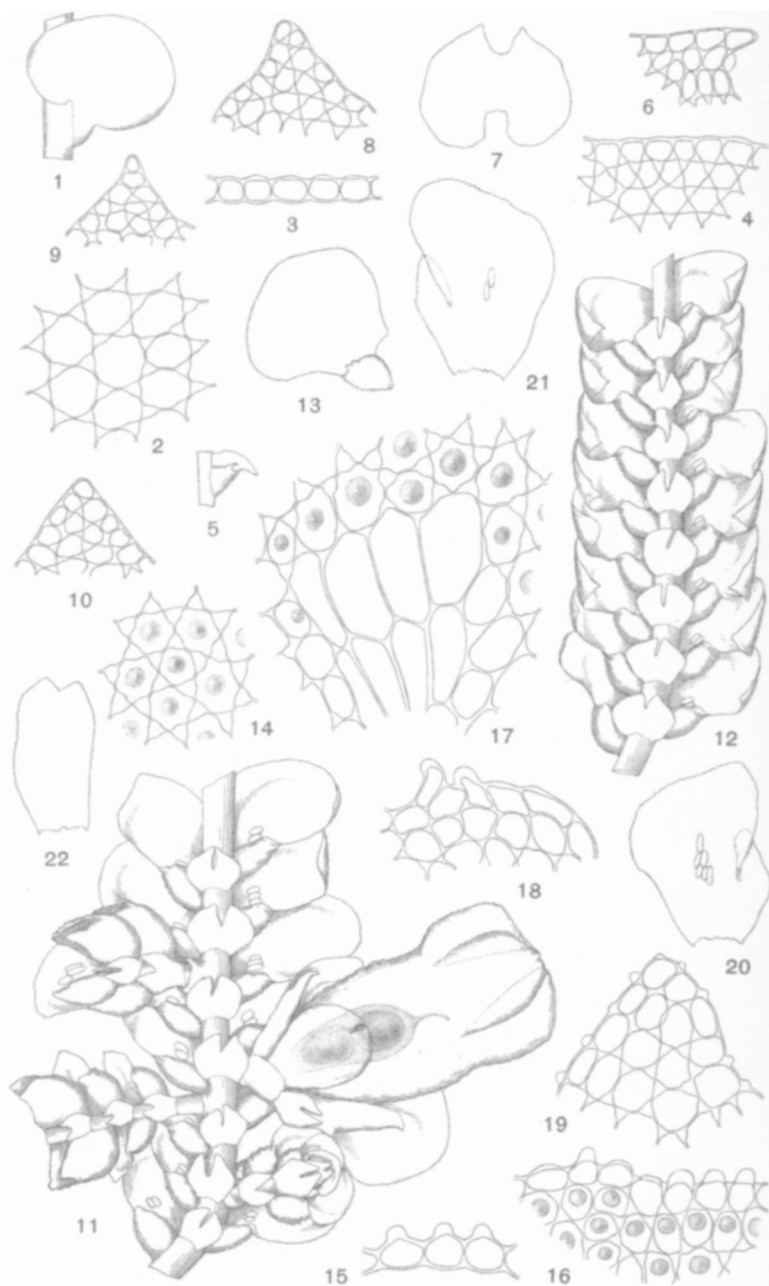
1-11. HARPALEJEUNEA SUBACUTA Evans.

12-24. HARPALEJEUNEA UNCINATA Steph.



1-9. *HARPALEJEUNEA HETERODONTA* Evans.

10-23. *CYRTOLEJEUNEA HOLOSTIPA* (Spruce) Evans.



1-10. EUOSMOLEJEUNEA TRIFARIA (Nees) Schiffn.

11-22. TRACHYLEJEUNEA AQUARIUS (Spruce) Evans.

megalantha and *L. erectifolia*, although included in *Cyclostipa*, might perhaps be better placed among the species of *Micro-Lejeunea*. In 1887, he transferred *L. erectifolia* to this subgenus and, in 1894, pursued the same course with *L. holostipa* and *L. megalantha*. Even the removal of these three species does not leave a wholly uniform residue, and it is probable that the remaining species will in time be distributed among other genera of the Lejeuneae. In the light of our present knowledge, it seems wisest to restrict the name *Harpalejeunea* to the section *Cardiostipa*, fully recognizing the close relationship of this emended genus to certain of the *Cyclostipae* as well as to the genera *Strepsilejeunea* and *Trachylejeunea*.

The genus *Harpalejeunea* as thus restricted is composed of small species, the majority of which are tropical, and it is apparently best represented in the tropical forests of America. The genus, however, is not restricted to the tropics. Several well-marked species are known from Patagonia and New Zealand, and *H. ovata* (Hook.) Schiffn., which may be considered the type of the genus, is now known in western Europe from Norway to Portugal and in the eastern United States from Virginia to Georgia. Comparatively few of the species grow on living leaves and still fewer occur on rocks. Several species are found creeping over large caespitose hepatics, such as species of *Bazzania* or *Schistochila*, but the majority prefer the trunks of trees or rotten logs, where they either grow mixed with other prostrate hepatics or form pure thin mats of considerable extent.

The leaves of *Harpalejeunea* are characterized by widely spreading, falcate-ovate lobes, which are gradually narrowed toward the apex. In some cases the apex, which is often reflexed, is extended as a long and slender acumen; in other cases it is more or less bluntly pointed. Intermediate conditions are frequent, and a considerable degree of variation may often be found in a single species. The margin of the lobe varies from entire to sharply spinose, and in this respect, also, certain species are exceedingly variable. The lobule is of fair size and is strongly inflated with an arched keel, the latter forming a distinct angle with the postical margin of the lobe. The free margin of the lobule is strongly involute, and the apex is tipped with a single projecting cell. At the proximal base

of this cell, which is commonly more or less curved, there is a slight depression in which a hyaline papilla is situated, very much as in *Drepanolejeunea*. The apical tooth and the lunulate sinus connecting it with the end of the keel assist in forming the opening into the water-sac. Sometimes the latter widens out abruptly just within the opening, but there is commonly a narrow and curved passage-way leading from the enlarged part of the water-sac to the external air. The cells of the lobes are comparatively small and are commonly plane or nearly so on their free surfaces; their vertical walls are either slightly and uniformly thickened or show small but distinct trigones. In a number of species a distinct group of four elongated cells may be detected at the base of the lobe, similar in many respects to those found in *Drepanolejeunea subulata* and its allies. Usually, however, the two cells of this group which are turned toward the antical margin of the lobe become modified into bulging ocelli, and sometimes one or both of the remaining cells undergo a similar transformation. In other species the position of the ocelli is less definite, but their occurrence in some part of the lobe can almost always be demonstrated.

The underleaves of *Harpalejeunea* are unique among the Lejeuneae. They are of small size and widen abruptly from a narrow base into an obcordate expansion, the apical sinus being shallow and varying from lunulate to subacute; the lobes of the underleaves are more or less divergent and are broad and rounded at their extremities.

The species of *Harpalejeunea* are almost always dioicous. The branch bearing the female inflorescence varies greatly in length but the flower itself is invariably subtended by one or two innovations. The perichaetial bracts are more bluntly pointed than the leaves and are sometimes narrowly winged along the keel. The perianth is sharply five-keeled in the upper part, but the keels, although distinctly winged in several species, are never produced as horns. Here, again, the genus shows a certain approach to *Drepanolejeunea subulata* and *D. anoplantha*.

Three species of *Harpalejeunea* from Puerto Rico have been studied by the writer. The first of these is much more abundant than the others and was at one time referred by Stephani to *Lejeunea* (*Harpa-Lej.*) *stricta* Lindenb. & Gottsche, a species orig-

inally known from Mexico. Although closely related to *L. stricta*, the Puerto Rico plant is now regarded by Stephani as specifically distinct, and it is described in the present paper as new. The second species studied is *H. uncinata* Steph., heretofore known from several other West Indian islands; the third is a rare epiphyllous species, which is apparently undescribed.

A fourth species from Puerto Rico, *Lejeunea patentissima* Hampe & Gottsche,* is also referred to *Harpalejeunea* by Stephani† and by Schiffner.‡ The original material of this species was collected by Schwanecke, and there seems to be no evidence of its having been found on the island a second time. The type-specimens are preserved in the Gottsche herbarium at Berlin and in the Hampe herbarium in the British Museum. Unfortunately these specimens are fragmentary and for the most part sterile. Even the vegetative organs, however, indicate that the plant is not a typical *Harpalejeunea*, but that it has much more in common with *Ceratolejeunea*, and the single preserved perianth shows conclusively that the species should be referred to the latter genus. *Lejeunea patentissima* will not be included, therefore, among the species of *Harpalejeunea*, the descriptions of which immediately follow.

***Harpalejeunea subacuta* sp. nov.**

Lejeunea (*Harpa-Lejeunea*) *stricta* Steph. Hedwigia, 27: 291.
1888. Not *Lejeunea stricta* Lindenb. & Gottsche; G. L.
& N. Syn. Hep. 756. 1847.

Pale or bright green, often becoming brownish upon drying, growing in depressed mats: stems 0.05 mm. in diameter, prostrate but rather loosely adherent to substratum, very sparingly branched, the branches widely spreading: leaves contiguous to slightly imbricated, the lobes widely spreading, convex, often reflexed at the apex, falcate-ovate, 0.3 mm. long, 0.17 mm. wide, attached by an almost longitudinal line of insertion, gradually narrowed beyond lobule to apex, margin entire or nearly so, antical margin decurrent by a single cell, strongly curved but rarely arching beyond axis, postical margin straight or slightly curved, apex varying from rounded to subacute, on leaves of small branches sometimes

* Linnaea, 25: 355. 1852.

† Hedwigia, 27: 288. 1888.

‡ Bot. Jahrb. 23: 591. 1897.

acute and occasionally tipped with two superimposed cells ; lobule ovoid, 0.17 mm. long, 0.1 mm. wide, strongly inflated, somewhat constricted in outer part thus forming a curved and narrow passage-way leading into the water-sac, keel strongly arched, slightly roughened in outer part from projecting cells, free margin more or less involute, straight or nearly so to apex then passing by a broad and shallow sinus to end of keel, apical tooth slightly curved ; cells of lobe plane or nearly so, averaging 10μ at edge and $16 \times 12\mu$ in the middle and toward the base, walls slightly thickened with very indistinct trigones and occasional intermediate thickenings ; ocelli commonly two, placed end to end at the base of the lobe, 30μ long and 18μ wide : underleaves distant, broadly obcordate, 0.5 mm. long, 0.07 mm. wide, narrowed toward base, bifid about one fifth with a shallow obtuse sinus and broad, rounded, diverging lobes, each about four cells broad at the base ; rhizoids very scanty, sometimes growing from a rudimentary disc in the basal region of an underleaf : inflorescence dioicous : ♀ inflorescence on a leading branch, more rarely on a short branch, innovating on one side, the innovation commonly simple and sterile, rarely floriferous ; bracts suberect, somewhat complicate, the keel slightly roughened from projecting cells but not winged, subequally bifid, the lobe ovate to obovate, 0.4 mm. long, 0.25 mm. wide, gradually narrowed to the obtuse or rounded apex, lobule similar to the lobe but narrower, measuring 0.19 mm. in width, margin entire ; bracteole connate with one or both bracts at base, oblong, 0.35 mm. long, 0.27 mm. wide, bifid one tenth to one third with lunulate to obtuse sinus and rounded, erect or slightly diverging lobes, margin entire or nearly so ; perianth about half exserted, oblong, 0.65 mm. long, 0.35 mm. wide, narrowed toward base, truncate above and with a short narrow beak, sharply five-keeled except in the basal region, the keels rounded above and smooth or slightly roughened along their edges : ♂ inflorescence and mature sporophyte not seen (*pl.* 20, f. 1-11).

On bark of trees. North slope of the Luquillo Mountains, Heller (1141, type, 4708a, 4719 *p. p.*, 4721 *p. p.*, 4729, 4731 *p. p.*, 4731a, 4732a, 4733, 4734 *p. p.*). El Yunque, Evans (3, 149). Originally collected by *Sintenis*.

The close relationship which exists between *Harpalejeunea ovata* and *Lejeunea stricta* has already been commented upon by Spruce* and by Stephani.† *H. subacuta* is closely allied to both these plants and the three together constitute a group of species so very

* Hep. Amaz. et And. 170. 1884.

† Hedwigia, 27 : 291. 1888.

similar to one another that the greatest care must be exercised in separating them. At the same time the differential characters, although so slight, appear to be constant.

In *L. stricta* the leaves are much more sharply pointed than in *H. subacuta* and commonly end in a row of from two to four cells; the leaf-cells have slightly thinner walls and the trigones are in consequence a little more prominent; the underleaves differ in being about as long as broad (measuring 0.075 mm. in length) and in having less divaricate lobes. The material of *L. stricta* studied by the writer is from Liebmann's original collection and was kindly communicated by Herr Stephani. The specimens are destitute of female flowers and perianths, but these organs, which are fully described by Gottsche,* afford a few additional differences, the bracts being winged along the keel and the keels of the perianth being denticulate in the upper part.

In *Harpalejeunea ovata* the leaves are very similar in shape to those of *H. subacuta*, and the apices of the lobes vary from obtuse to short-acuminate. The northern species, however, is a little more robust, but at the same time the leaf-cells, which measure a little larger than those of *H. subacuta*, are more delicate in texture and show more distinct trigones. The underleaves of *H. ovata* measure 0.08 mm. in length and 0.1 mm. in width and the apical sinus is shallow and commonly lunulate, in many cases being scarcely evident. The perichaetial bracts and bracteoles agree pretty closely in the two species, but those of *H. subacuta* are relatively broader and the bracteal lobes are more nearly equal in size.

HARPALEJEUNEA UNCINATA Steph.

Harpalejeunea uncinata Steph. Hedwigia, **35**: 97. 1896.

Pale green, often becoming brownish upon drying, growing in depressed mats: stems 0.035 mm. in diameter, prostrate but rather loosely adherent to substratum, sparingly branched, the branches widely spreading: leaves contiguous to slightly imbricated, the lobe widely spreading (in outer part), convex, sometimes reflexed at the apex, falcate-ovate, 0.3 mm. long, 0.15 mm. wide, attached by an almost longitudinal line of insertion, margin entire near antical base, otherwise irregularly crenulate or denticulate from projecting cells, antical margin decurrent by a single cell, strongly

* Mex. Leverm. 198. 1863.

curved and arching partly or entirely across axis, postical margin straight or slightly curved, apex abruptly apiculate to cuspidate, ending in a single row of from two to five cells, on leaves of slender branches sometimes obtuse; lobule ovoid, 0.15 mm. long, 0.08 mm. wide, strongly inflated, abruptly constricted in outer part, thus forming a curved and narrow passage-way leading into the water-sac, keel strongly arched, smooth or nearly so, free margin either involute or appressed to lobe, passing beyond apex by a shallow sinus to end of keel, apical tooth slightly curved; cells of lobe plane or nearly so, averaging $13 \times 11 \mu$, scarcely varying in size in different parts of the lobe, walls slightly thickened with scarcely evident trigones and occasional intermediate thickenings; ocelli commonly two, placed end to end at the base of the lobe, 23μ long and 14μ wide: underleaves distant, broadly obcordate, 0.05 mm. long, 0.07 mm. wide, narrowed toward base, bifid about one third with an obtuse sinus and broad, diverging, rounded or truncate lobes, each about four cells wide at base and three cells long; rhizoids scanty, not growing from a disc: inflorescence dioicous: ♀ inflorescence sometimes on a leading branch, sometimes on a short branch, innovating on one side with a commonly sterile innovation; bracts obliquely spreading, complicate, unequally bifid, the lobe ovate to obovate, 0.4 mm. long, 0.25 mm. wide, apex obtuse to rounded, margin more strongly crenulate or denticulate than in the leaves, keel often with a narrow entire wing one or two cells wide, lobule similar in shape to lobe, 0.35 mm. long, 0.19 mm. wide, apex sometimes retuse, margin slightly and irregularly crenulate or denticulate; bracteole slightly connate with one bract, oblong-obovate, 0.3 mm. long, 0.25 mm. wide, bifid about one third with slightly diverging blunt divisions, margin as in lobule; perianth about half exserted, oblong, 0.6 mm. long, 0.35 mm. wide, slightly narrowed toward base, truncate above and with a short beak, sharply five-keeled except in basal region, the keels narrowly winged in the upper part with dentate to spinose wings, the projections consisting of from one to three cells: ♂ inflorescence and mature sporophyte not seen (*pl.* 20, *f.* 12-24).

On bark of trees. North slope of the Luquillo Mountains, *Heller* (4763 *p. p.*). Also known, in sterile condition, from the following localities: Cuba, *Wright*; Santo Domingo, *Eggers*; Trinidad, *Crueger*.

Although the writer has been unable to secure authentic specimens of *H. uncinata*, his determination of the species has been confirmed by Herr Stephani. The description given above sup-

plements, in several important respects, the original description, which was drawn from sterile material. *H. uncinata* is about the same size as *H. subacuta* and resembles it closely at first glance. It is remarkable for the long and slender apices of its lobes, which stand out from the axis at an angle of 90° or more in explanate leaves. This character will at once distinguish the species from *H. subacuta* and the denticulate or crenulate leaf-margins will also be of assistance. Lobules, leaf-cells, ocelli and underleaves are strikingly alike in the two species. In the perichaetial bracts of *H. uncinata*, certain of the foliar characters become accentuated while others disappear. The margin of the lobe, for example, is much more toothed than on ordinary leaves, but the apex is rounded or obtuse instead of being extended as a filiform point. Even when a tooth is present at the apex, it cannot be distinguished from the neighboring teeth. The distinctly toothed bracts and bracteoles and the dentate or spinose wings on the keels of the perianth are also good differential characters in separating the species from *H. subacuta*.

***Harpalejeunea heterodonta* sp. nov.**

Pale green, scattered among other epiphyllous hepatics: stems 0.06 mm. in diameter, prostrate and closely adherent to substratum, irregularly branched, the branches obliquely to widely spreading: leaves distant to subimbricated, the lobe widely spreading (in outer part), plane or slightly convex even in apical region, falcate-ovate, 0.35 mm. long, 0.2 mm. wide, gradually narrowed into a long-attenuate apex, attached by an almost longitudinal line of insertion, antical margin decurrent by a single cell, straight or nearly so and entire near base, then strongly curved and varying from irregularly crenulate to spinose, the crenulations being slightly projecting cells and the spines sometimes attaining a length of five cells and a width of three cells at the base, postical margin straight or slightly curved, obscurely crenulate from projecting cells, apex commonly terminating in a row of two or three cells; lobule ovoid, 0.17 mm. long, 0.1 mm. wide, strongly inflated, abruptly constricted in outer part thus forming a very short, slightly curved passage-way leading into the water-sac, keel strongly arched, slightly roughened in outer part from projecting cells, free margin straight or nearly so, involute to beyond apex then passing by a shallow lunulate sinus to end of keel, apical tooth short and slightly curved; cells of lobe plane or nearly so,

averaging $14\ \mu$ in diameter at edge and $18 \times 16\ \mu$ elsewhere, thin-walled, trigones and occasional intermediate thickenings small but distinct; ocelli commonly two, placed end to end at the base of the lobe, $30\ \mu$ long, $21\ \mu$ wide: underleaves distant, broadly obcordate, 0.07 mm. long, 0.08 mm. wide, narrowed toward base, bifid one fourth to one third with a shallow lunulate sinus and broad, diverging rounded lobes, each five or six cells long and four or five cells wide at base, margin obscurely crenulate from projecting cells; rhizoids numerous, rarely growing from a rudimentary disc: inflorescence not seen (*pl.* 21, *f.* 1-9).

On living leaves. El Yunque, *Evans* (20 *p. p.*, 160 *p. p.*).

Although *H. heterodonta* is known in sterile condition only, its foliar characters are so peculiar that it can hardly be confused with other members of the genus. When the leaf-margins are only slightly crenulate, the species bears some resemblance to *H. uncinata*, but even on such specimens it is usually possible to find leaves with more strongly marked teeth, and the leaf-cells are constantly a little longer than in Stephani's species and have thinner walls with more evident trigones. The marginal spines of *H. heterodonta* are less frequent on robust stems than on slender branches.

Apparently *Lejeunea* (*Harpalejeunea*) *tridens* Besch. & Spruce* is closely related to the present species. *L. tridens* is likewise West Indian; it was originally known from Guadeloupe, but has since been reported by Spruce from the neighboring island of Dominica.† The leaves of this species, as its name implies, are almost constantly tridentate and the teeth are usually long and slender enough to be called spines. Judging from the published figures of *L. tridens*, the regularity of these foliar teeth or spines gives the plant a very different appearance from what we find in *H. heterodonta*. *L. tridens* differs, also, in its place of growth and in its thick-walled leaf-cells.

CYRTOLEJEUNEA

Attention has already been called to *Lejeunea holostipa* Spruce, a species originally placed by its author in the subgenus *Harpa-Lejeunea* and afterwards transferred to *Microlejeunea*. This inter-

* Bull. Soc. Bot. France, 36: clxxxi. *pl.* 13. 1890.

† Jour. Linn. Soc. Bot. 30: 341. 1894.

esting plant is widely distributed in tropical America, and has recently been found in Puerto Rico ; it is almost always mixed with other hepatics and is rarely fertile. Although first described by Spruce, *L. holostipa* was also known to Gottsche from specimens collected in Cuba by C. Wright and was distributed in the *Hepaticae Cubenses* under the name "*Lejeunea pseudocucullata* G." Within recent years this manuscript species has been described by Stephani as an *Archilejeunea* and by Schiffner as a *Euosmolejeunea*, not appreciating, apparently, that it was synonymous with *Lejeunea holostipa*. It is evident that the greatest diversity of opinion exists regarding the systematic position of the species. This is due to certain very peculiar characters which it presents, and, as a matter of fact, it does not fit naturally into any one of these four divisions of the *Lejeuneae* to which it has been referred. It seems advisable, therefore, to propose a new genus for its reception, a course already suggested by Schiffner. The generic characters of this new genus and the specific characters of its single known species are as follows :

***Cyrtolejeunea* gen. nov.**

Plants small, bright green : stems prostrate, sparingly branched : leaves distant to subimbricated, the lobe convex, not widely spreading, rounded at the apex, entire ; lobule strongly inflated, free margin with a long terminal tooth composed of a single cell and bearing a hyaline papilla in a slight depression at its distal base (*i. e.*, at the beginning of the apical sinus) : cells of lobe convex : underleaves orbicular, undivided, entire : ♀ inflorescence on a leading branch, innovating on one side ; bracts unequally bifid ; bracteole shortly bifid ; perianth sharply five-keeled and distinctly beaked, the keels not produced as horns. (Name from *κυρτος*, curved or convex, and *Lejeunea*.)

***Cyrtolejeunea holostipa* (Spruce)**

Lejeunea (*Harpa-Lejeunea*) *holostipa* Spruce, Hep. Amaz. et And. 171. 1884.

Lejeunea (*Microlejeunea*) *holostipa* Spruce, Jour. Linn. Soc. Bot. 30 : 348. 1894.

Archilejeunea pseudocucullata Steph. Hedwigia, 34 : 61. 1895.

Lejeunea pseudocucullata Gottsche ; Wright, Hep. Cubenses ; Schiffn. Bot. Jahrb. 23 : 583. 1897 (as synonym).

Euosmolejeunea pseudocucullata Schiffn. l. c.

Bright green, sometimes becoming brownish or yellowish upon drying, growing in depressed tufts or more commonly mixed with other bryophytes: stems prostrate but not closely adherent to substratum, 0.04 mm. in diameter; branches widely spreading, sometimes with rudimentary leaves: leaves distant to slightly imbricated, the lobe obliquely spreading, strongly convex and revolute along postical margin, ovate to orbicular-ovate, slightly or not at all falcate, 0.25 mm. long, 0.17 mm. wide, attached by an almost longitudinal line of insertion except at antical base, margin entire, antical margin more or less curved, sometimes arching partly or entirely across axis, postical margin somewhat curved in explanate leaves, apex broadly rounded; lobule sphaero-ovoid, 0.17 mm. long, 0.12 mm. wide, strongly inflated, keel, convex and strongly arched, roughened from projecting cells, free margin straight and entire, involute to base of apical tooth, sinus broad and shallow, apical tooth straight and slender, forming a continuous line with the inner part of the free margin when flattened out; cells of lobe convex, averaging $9\ \mu$ at the margin of the lobe and $14 \times 12\ \mu$ in other regions, either thin-walled throughout or with minute but more or less distinct trigones; ocelli none: underleaves distant, orbicular, 0.08 mm. long, subcuneate at the base, rounded or very rarely bicrenulate at the apex, margin entire; rhizoids commonly scanty, growing from the bases of the underleaves: inflorescence dioicous: ♀ inflorescence with a sterile innovation, bracts scarcely complicate, shortly and unequally bifid, the lobe broadly orbicular-ovate, 0.4 mm. long, 0.3 mm. wide, entire, rounded at apex, lobule lanceolate, acute, 0.3 mm. long, 0.07 mm. wide; bracteole free or nearly so, obovate, strongly convex postically, 0.3 mm. long, 0.25 mm. wide, bifid one fourth or less with broad rounded lobes and obtuse sinus; perianth about half exserted, oval to obovoid, 0.7 mm. long, 0.35 mm. wide, rounded at the apex and with a rather long and slender beak, narrowed toward base, sharply five-keeled in the upper part, the antical keel a little lower than the others, keels sometimes obscurely winged, surface of perianth smooth: ♂ inflorescence usually intercalary on a leading branch, bracts in one to four pairs, strongly concave and inflated, shortly and subequally bifid, the lobes and lobules rounded; bracteoles (when present) similar to ordinary underleaves; antheridia and mature sporophytes not seen (*pl.* 21, *f.* 10-23).

On bark of trees, rarely on living leaves. El Yunque, *Evans* (21 *p.p.*, 46 *p.p.*). The type-specimens were collected by *Spruce* in Brazil and distributed in *Hepaticae Spruceanae*. Other stations for the species are the following: Cuba, *Wright*; Venezuela, *Moën*; St. Vincent, *Elliott*.

In spite of its undivided underleaves the systematic position of *Cyrtolejeunea* seems to be among the Lejeuneae Schizostipae rather than among the Holostipae, where it was placed by Stephani. It shows, to be sure, certain characters in common with *Archilejeunea* such as its single subfloral innovation and five-keeled perianth, but it is so much smaller than typical members of this genus and so much more delicate in texture that it would hardly be natural to include it among them. It possesses, moreover, a lobule of an entirely distinct type, and this will serve to separate it not only from *Archilejeunea* but from *Harpalejeunea*, *Microlejeunea* and *Euosmolejeunea* as well.

The lobule in the Lejeuneae often affords characters of more than specific importance. Certain of these characters have long been recognized by writers; others either have been overlooked or have not been fully appreciated, partly because the lobule is not always well developed, partly because it can rarely be satisfactorily studied without dissecting off the leaves from the stem and flattening them under pressure. These characters relate not only to the shape, size and degree of inflation of the lobule but also to the peculiarities of its free margin, with respect especially to the apex and the position of the hyaline papilla which is commonly found in the immediate vicinity of the apex. Throughout the genus *Drepanolejeunea*, for example, a more or less curved tooth, composed of a single projecting cell, is found at the apex of the lobule, and the hyaline papilla is situated at the proximal base of this tooth in a depression. Essentially the same type of lobule is developed in *Harpalejeunea* (*pl. 20, f. 9, 19*), *Trachylejeunea* and *Leptolejeunea*. The curved tooth in all these genera plays an important part in the formation of the opening into the water-sac, and, in the case of *Leptolejeunea exocellata* and its immediate allies, exhibits marked modifications due perhaps to the presence of the large basal ocellus in the lobe. In *Microlejeunea* the apex is tipped with a single slightly projecting cell which is blunt and scarcely or not at all curved. The hyaline papilla in this genus is sometimes borne on the projecting cell itself but commonly occupies the same position as in the other genera to which allusion has just been made. In *Cyrtolejeunea* the lobule bears at its apex a long and slender sharp-pointed and straight tooth, consisting of a single projecting cell, and the hyaline

papilla is borne at its distal base (*pl. 21, f. 18, 19*). In *Euosmolejeunea* the papilla is likewise borne at the distal base of the apical tooth but the tooth itself is short and rather bluntly pointed, projecting only for a short distance beyond the adjoining cells (*pl. 22, f. 6*).

Of all the genera to which *Cyrtolejeunea holostipa* has been referred, it is perhaps most closely related to *Microlejeunea*, from which its undivided underleaves and peculiar lobules should doubtless exclude it. From *Harpalejeunea* it differs not only in these characters, but also in its rounded obliquely spreading leaves and in its lack of ocelli; from *Euosmolejeunea* it differs in its small size and green color, as well as in its small leaf-cells with delicate walls. There are no Puerto Rico species with which it could readily be confused.

EUOSMOLEJEUNEA

The typical members of the genus *Euosmolejeunea* are among the most easily recognized Lejeuneae of the tropics. They are fairly robust for species with bifid underleaves and are usually characterized by a peculiar yellowish green color and by a rather pronounced odor. At first glance they perhaps bring to mind *Omphalanthus filiformis*, which, however, is even more robust and is further distinguished by its undivided underleaves and by its perianth without keels. The leaves in *Euosmolejeunea* have well-developed lobes and small lobules; the lobes are broad and spread widely from the stem, they are more or less convex and are commonly broad and rounded at the apex and their margins are entire or nearly so. The lobules are strongly inflated, and their free margins are involute to beyond the apex; the latter is tipped by a single slightly projecting cell, which is straight and not sharply pointed. The hyaline papilla is at the distal base of this projecting cell. The leaf-cells are firm and are frequently convex; trigones are conspicuous, but intermediate thickenings are wanting or exceedingly rare. Ocelli are also wanting. The underleaves are large and orbicular, in certain species extending almost to the apices of the lobes; they are commonly cordate at the base, and the apical sinus varies from lunulate to acute. In a few species the underleaves are much smaller and are cuneate at the base; in one or two species which have been referred to the genus, the

underleaves are undivided. The ♀ inflorescence is sometimes borne on a short branch and sometimes on a leading branch, but it is invariably subtended by one or two innovations. The bracts are similar to the leaves, but are sometimes sharply pointed. The perianth is sharply five-keeled, but is never provided with horns; its surface is often roughened by projecting cells. In common with many other genera of the Lejeuneae the basal region of the perianth becomes elongated after fertilization and thus modifies to a considerable extent the form of the organ. Neither gemmae nor propagula have been noted in the genus.

The affinities of *Euosmolejeunea* are not altogether clear, but it is hardly probable that it is closely related to any of the other genera treated in the present paper. It is introduced here largely for comparison with *Cyrtolejeunea*, and the most important differences between the two genera have already been noted. It is probable that *Cheilolejeunea* and *Pycnolejeunea* are much nearer allies.

The species of *Euosmolejeunea* are commonly found on the bark of trees or on rotten logs, more rarely on shaded rocks or stones. In many cases they grow mixed with other hepaticae, usually Lejeuneae, but one finds, not infrequently, broad pure mats of considerable size.

Three species of the genus are now known from Puerto Rico, viz: *E. duriuscula*, *E. opaca* and *E. trifaria*. The first two of these have a wide distribution in tropical America and are also known from the subtropical regions of the United States along the Gulf or Mexico. *E. trifaria* is even more widely distributed, being found in nearly all the tropical regions of the globe. Since *E. duriuscula* and *E. opaca* have recently been described and figured by the writer,* nothing about them is noted here except their distribution on the island. *E. trifaria*, however, is described in full.

EUOSMOLEJEUNEA DURIUSCULA (Nees) Evans

On rotten logs. North slope of the Luquillo Mountains, Heller (4649 *p.p.*, 4755). Also collected by *Sintenis* (52, 53).

EUOSMOLEJEUNEA OPACA (Gottsche) Steph.

On trees and rocks. North slope of the Luquillo Mountains, Heller (4325, 4761 *p.p.*). Three miles east of Santurce,

* Mem. Torrey Club, 8: 135-141. *pl.* 18, *f.* 12-23. *pl.* 19, *f.* 1-11. 1892.

Heller (461). Utuado, *Underwood & Griggs*. El Yunque
Evans (1).

EUOSMOLEJEUNEA TRIFARIA (Nees) Schiffn.*

Yellowish green, varying to bright green and often becoming brownish upon drying, growing in depressed mats: stems 0.1 mm. in diameter, sparingly and irregularly branched, the branches obliquely to widely spreading: leaves loosely imbricated, the lobe widely spreading, usually convex and more or less revolute at the apex, broadly ovate-orbicular, falcate, 0.5 mm. long, 0.47 mm. wide, attached by an almost longitudinal line of insertion except for a very short distance at antical base, margin vaguely and irregularly crenulate from projecting cells, antical margin strongly curved from the base, arching in most cases considerably beyond axis, postal margin strongly curved and forming a distinct angle (usually of about 90°) with the keel, apex broad and rounded; lobule triangular-ovoid, 0.15 mm. long, 0.09 mm. wide, strongly inflated but commonly constricted near orifice, keel straight or slightly curved, roughened from projecting cells, free margin strongly involute to beyond apex, then passing by a short lunulate sinus to end of keel, entire and almost straight when flattened out, apical tooth straight and continuous with inner part of free margin, short and bluntly pointed, normally appressed to the lobe and taking part in the formation of the opening into the water-sac; cells of lobe averaging 14 μ at edge of leaf, 22 μ in the middle and 25 μ at the base, more or less convex with a distinctly thickened outer wall, trigones large, triangular, with straight or slightly bulging sides, rarely confluent, intermediate thickenings very rare: underleaves loosely imbricated, broadly orbicular, 0.5 mm. long, 0.6 mm. wide, convex postically, shortly bifid — one fourth or less — with an acute to lunulate sinus and erect or slightly connivent divisions, obtuse to acute and often apiculate at the apex, tipped with a single cell or more rarely with two superimposed cells, distinctly cordate at the base and attached by a strongly curved line of insertion, margin and cells as in leaf-lobes; rhizoids commonly present, forming little tufts at the bases of the underleaves: inflorescence autoicous: ♀ inflorescence commonly borne on a leading branch, more rarely on a short branch, innovating usually on only one side, the innovation commonly long and repeatedly

* On account of its great variability and wide distribution, *E. trifaria* has many synonyms. A list of these was published by Stephani in 1888 (*Hedwigia*, 27: 292), and the whole synonymy was afterwards given very fully by Schiffner (*Conspect. Hepat. Arch. Indici*, 263. 1898). It seems unnecessary, therefore, to enumerate the synonyms here. The species has been figured by Stephani, under the name *Lejeunea grandistipula* (*Bol. Soc. Broteriana*, 4: pl. 2, f. 19-21. 1886).

floriferous, more rarely short and sterile; bracts unequally bifid, the lobe obliquely spreading, ovate to oblong, 0.65 mm. long, 0.45 mm. wide, apex rounded to very obtuse, margin as in leaves, lobule lanceolate to narrowly oblong, 0.3 mm. long, 0.09 mm. wide, acute to obtuse at the apex; bracteole free, similar to the underleaves but relatively longer, measuring 0.6 mm. in length and 0.5 mm. in width, bifid about one sixth; perianth when young about half exserted, afterwards pushed outward through the growth of the basal region, oblong to oblong-obovate, 1 mm. long, 0.5 mm. wide when well developed, narrowed toward base, broad and rounded or truncate at the apex with a short but distinct beak, sharply five-keeled, the antical keel extending from the apex to about the middle of the perianth, the others extending nearly to the base, surface of perianth more or less roughened from projecting cells: ♂ inflorescence basal or intercalary on a short branch; bracts in two to five pairs, strongly inflated, unequally bifid, the lobe obtusely pointed, the lobule sharper and often apiculate; bracteoles present at base of spike, smaller than the underleaves and more deeply bifid; antheridia in pairs: mature sporophyte not seen (*pl.* 22, *f.* 1-10).

On trees. North slope of the Luquillo Mountains, Heller (4719 *p. p.*, 4721 *p. p.*). El Yunque, Evans (27, 33). First collected on the island by Schwanecke.

So far as we know at present *E. trifaria* is the only American species of *Euosmolejeunea*, in which the inflorescence is autoicous. Even here unisexual individuals occasionally occur, but, since they are usually found in the same mats as typical bisexual individuals, their presence need not often confuse us in recognizing the species. The monoicous inflorescence doubtless accounts for the frequency of perianths in *E. trifaria* as compared with dioicous forms.

Probably the closest ally of *E. trifaria*, in the West Indies at least, is the dioicous *E. opaca*. If for any reason there is difficulty in demonstrating the inflorescence, the slight differences in the vegetative organs are usually distinct enough to separate these two species. *E. opaca* is a little less robust than *E. trifaria*, the lobes of its leaves are less convex, the leaf-cells are plane or nearly so, and the trigones of both leaves and underleaves are less conspicuous. Of course all of these vegetative characters are variable and largely dependent on external conditions, so that the positive determination of immature or poorly developed specimens is not always possible.

TRACHYLEJEUNEA

The genus *Trachylejeunea* is not a very clearly defined group of species. It is characterized primarily by the roughness of its leaves and perianths. This roughness is due in part to very convex cell-walls, in part to the presence of a large median tubercle or wart on each cell. The roughness commonly affects the antical surface of the lobe, the postical surface of the lobule and the outer surface of the perianth, but in some species is scarcely evident except on the keels of the latter organ. Roughness of this character is by no means confined to *Trachylejeunea*. We find it, for example, equally well marked, in many species of *Cololejeunea* as well as in a few species of *Strepsilejeunea* and in certain other genera of the Lejeuneae. Aside from their roughness the leaf-cells of *Trachylejeunea* are variable; sometimes they are thin-walled throughout, sometimes provided with conspicuous local thickenings. Ocelli are usually present at the base of the lobe. The species belonging to the present genus are commonly more robust than in either *Harpalejeunea* or *Strepsilejeunea*. The lobes of their leaves are mostly blunt-pointed and are never acuminate (except in the very aberrant *T. acanthina* (Spruce) Schiffn.); the lobule is inflated and bears a slightly curved apical tooth with a hyaline papilla at its proximal base; the underleaves are rotund and bifid with a narrow sinus and suberect pointed divisions. The ♀ inflorescence is borne on a short branch which, in most species, does not innovate; the perianth is sharply five-keeled in the upper part and the keels, although sometimes obsoletely winged, are never produced as horns.

Comparatively few species of *Trachylejeunea* have been described. The majority of them grow on trees or on rotten logs in tropical forests, but a few are found in the South Temperate Zone. Two species have been recorded from the West Indies: *T. Spruceana* Steph.,* from Guadeloupe, and *T. prionocalyx* (Gottsche) Schiffn.,† from Cuba. Neither of these species has yet been found on Puerto Rico, but a third species, *Lejeunea* (*Trachy-Lejeunea*) *Aquarius* Spruce, occurs in recent collections.

* Hedwigia, 35: 138. 1896.

† Bot. Jahrb. 23: 592, pl. 15, f. 8-12. 1897.

Trachylejeunea Aquarius (Spruce)

Lejeunea (*Trachy-Lejeunea*) *Aquarius* Spruce, Hep. Amaz. et
And. 185. 1884.

Pale whitish green sometimes tinged with yellowish, growing in depressed mats or mixed with other bryophytes: stems 0.1–0.15 mm. in diameter, sparingly branched, the branches widely spreading: leaves imbricated, the lobe widely spreading, strongly convex and reflexed at the apex, falcate-ovate, sometimes broadly so, 0.6 mm. long, 0.45 mm. wide, attached by an almost longitudinal line of insertion except for a short distance near antical base, margin entire near antical base and also near keel, otherwise crenulate from projecting cells, sometimes obscurely serrulate or denticulate near apex, antical margin straight or slightly incurved near base, then strongly outwardly curved and arching to the middle of the axis or beyond, postical margin slightly curved, apex obtuse to subacute, on leaves of slender branches sometimes acute; lobule ovoid, 0.2 mm. long, 0.1 mm. wide, strongly inflated, keel strongly arched, roughened in outer part from projecting cells and warts, free margin strongly involute to beyond apical tooth, then passing by a very shallow sinus to end of keel, apical tooth slightly curved, hyaline papilla at proximal base of tooth in a depression bounded on the inner side by a second more or less distinct unicellular tooth; cells of lobe with strongly convex outer walls, averaging $18\ \mu$ at the margin and $24\ \mu$ in the middle, each cell (except near the base) bearing a median, blunt tubercle representing a local thickening of the convex wall, trigones large and conspicuous, rarely confluent, intermediate thickenings wanting; ocelli two to five in number, measuring $65 \times 28\ \mu$, situated in a group near the base of the lobe; tubercles occasionally present on margin between adjoining cells; cells of lobule also tuberculate: underleaves distant, broadly orbicular-rhombic, 0.25 mm. long, 0.3 mm. wide, bifid to about the middle with connivent or suberect lobes and narrow acute sinus, not cordate at base, margin entire; rhizoids growing in tufts from the bases of the underleaves: inflorescence autoicous: ♀ inflorescence borne on a short branch, innovating on one side with a short sterile innovation; bracts obliquely spreading, more or less complicate, unequally bifid, the lobe obovate, 0.75 mm. long, 0.45 mm. wide, apex rounded to very obtuse, margin and cells as in leaves, lobule lanceolate, 0.4 mm. long, 0.15 mm. wide, apex obtuse to subacute, margin slightly and irregularly crenulate or verruculose in upper part, cells otherwise smooth or nearly so; bracteole free, oblong to obovate, 0.6 mm. long, 0.3 mm. wide, bifid one eighth

to one sixth with obtuse lobes and sinus, margin as in lobule; perianth obovoid or clavate, 1.1 mm. long, 0.6 mm. in diameter, slightly narrowed toward base and truncate above, beak obsolete, terete toward base, sharply five-keeled in upper part, the keels rounded above and narrowly, often obsoletely alate, whole surface of perianth roughened, due in the lower part almost entirely to convex cell-walls, in upper part to tubercles: ♂ inflorescence occupying a short branch or terminal on a leading branch; bracts in two to ten pairs, strongly inflated, unequally bifid, the lobe mostly rounded, the lobule subacute; bracteoles similar to the underleaves but smaller, found only at the base of the spike; antheridia in pairs: ripe sporophyte not seen (*pl.* 22, *f.* 11-22).

On bark of trees. North slope of the Luquillo Mountains, *Heller* (4745). El Yunque, *Evans* (189 *p.p.*). Originally collected by *Spruce*, in Brazil, and distributed in *Hepaticae Spruceanae*.

The presence of a subfloral innovation in *T. Aquarius* was originally looked upon as a somewhat aberrant character. Within recent years, however, several other species have been referred to *Trachylejeunea*, in which an innovation of this nature is of occasional or even of constant occurrence. There is little danger of confusing any of the other Puerto Rico Lejeuneae with this very distinct species. Its robust size and pale color, together with its avidity in absorbing water, recall perhaps certain species of *Hygrolejeunea* or *Taxilejeunea*, but its strongly tuberculate leaves and perianth and its large lobules with their peculiar apices, will at once separate it from both these genera. From the genera *Harpa-lejeunea* and *Strepsilejeunea*, to which it is really more closely allied, it may be distinguished by its large size and blunter leaves, as well as by other less apparent differences.

Even among the other *Trachylejeuneae* of tropical America, *T. Aquarius* has no very near relatives. The South American *Lejeunea* (*Trachy-Lej.*) *pellucidissima* Spruce* and *L. (Trachy-Lej.) pandurantha* Spruce* resemble it somewhat in size, color and general appearance, but both of these species are destitute of true subfloral innovations, and their leaf-cells, although more or less convex, are without tubercles and are either thin-walled throughout or have walls which are slightly and uniformly thickened.

YALE UNIVERSITY.

* Hep. Amaz. et And. 184. 1884.

Explanation of Plates

PLATE 20

Harpalejeunea subacuta Evans. 1. Part of plant with perianth, postical view, $\times 40$. 2. Part of sterile stem, antical view, $\times 40$. 3. Cells from middle of lobe, $\times 360$. 4. Cells from antical margin of lobe, $\times 250$. 5-7. Apices of lobes, $\times 250$. 8. Base of lobe, showing ocelli, $\times 250$. 9. Apex of lobule, $\times 250$. 10. Underleaf, $\times 250$. 11. Bracts and bracteole, $\times 40$. The figures were all drawn from the type-specimens.

Harpalejeunea uncinata Steph. 12. Part of plant with ♀ inflorescence, postical view, $\times 40$. 13. Part of sterile stem, antical view, $\times 40$. 14. Perianth with involucre, postical view, $\times 40$. 15. Cells from middle of lobe, $\times 360$. 16. Cells from antical margin of lobe, $\times 250$. 17. Apex of lobe, $\times 250$. 18. Base of lobe, showing ocelli, $\times 250$. 19. Outer portion of lobule, $\times 250$. 20. Underleaf, $\times 250$. 21. Bract and bracteole, $\times 40$. 22. Bract, $\times 40$. 23. Cells from margin of bract, $\times 250$. 24. Cells from upper part of perianth-keel, $\times 250$. The figures were all drawn from specimens collected by A. A. Heller (no. 4763).

PLATE 21

Harpalejeunea heterodonta Evans. 1. Part of stem with branch, postical view, $\times 35$. 2. Branch, antical view, $\times 35$. 3. Cells from middle of lobe, $\times 310$. 4. Cells from antical margin of stem-leaf, $\times 220$. 5. Tooth from antical margin of branch-leaf, $\times 220$. 6. Apex of lobe, $\times 220$. 7. Base of lobe, $\times 220$. 8. Apex of lobule, $\times 220$. 9. Underleaf, $\times 220$. The figures were all drawn from the type-specimens.

Cyrtolejeunea holostipa (Spruce) Evans. 10. Part of stem with branch, antical view, $\times 55$. 11. Part of stem, postical view, $\times 55$. 12. Part of stem with perianth, postical view, $\times 55$. 13. ♂ inflorescence, postical view, $\times 55$. 14, 15. Cells from middle of lobe, showing variations in thickness of cell-wall, $\times 310$. 16. Apex of lobe, $\times 310$. 17. Base of lobe, $\times 310$. 18, 19. Apices of lobules, showing variation in thickness of cell-wall, $\times 310$. 20. Underleaf, $\times 310$. 21. Apex of aberrant underleaf, $\times 310$. 22. Bract, $\times 55$. 23. Bracteole, $\times 55$. Figs. 12, 13, 22 and 23, were drawn from specimens distributed by Spruce in *Hepaticae Spruceanae* (set belonging to the New York Botanical Garden); the remaining figures were drawn from specimens collected by the writer (nos. 21 and 46).

PLATE 22

Euosmolejeunea trifaria (Nees) Schiffn. 1. Leaf, antical view, $\times 35$. 2. Cells from middle of lobe, $\times 310$. 3. Same in cross-section, $\times 220$. 4. Cells from antical margin of lobe, $\times 220$. 5. Lobule, $\times 35$. 6. Apex of lobule, $\times 220$. 7. Underleaf, $\times 35$. 8-10. Apices of divisions of underleaves, $\times 220$. The figures were all drawn from specimens collected by the writer (no. 33).

Trachylejeunea Aquarius (Spruce) Evans. 11. Part of plant with ♂ branches and perianth, the subfloral innovation poorly developed, postical view, $\times 35$. 12. Part of sterile branch, postical view, $\times 35$. 13. Leaf, $\times 35$. 14. Cells from middle of lobe, $\times 220$. 15. Same in cross-section, $\times 220$. 16. Cells from antical margin of lobe, $\times 220$. 17. Basal part of lobe, showing three ocelli, $\times 220$. 18. Apex of lobule, $\times 220$. 19. Apex of one of the divisions of an underleaf, $\times 220$. 20, 21. Bracts, $\times 35$. 22. Bracteole, $\times 35$. The figures were all drawn from specimens collected by A. A. Heller (no. 4745).